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LECTURE

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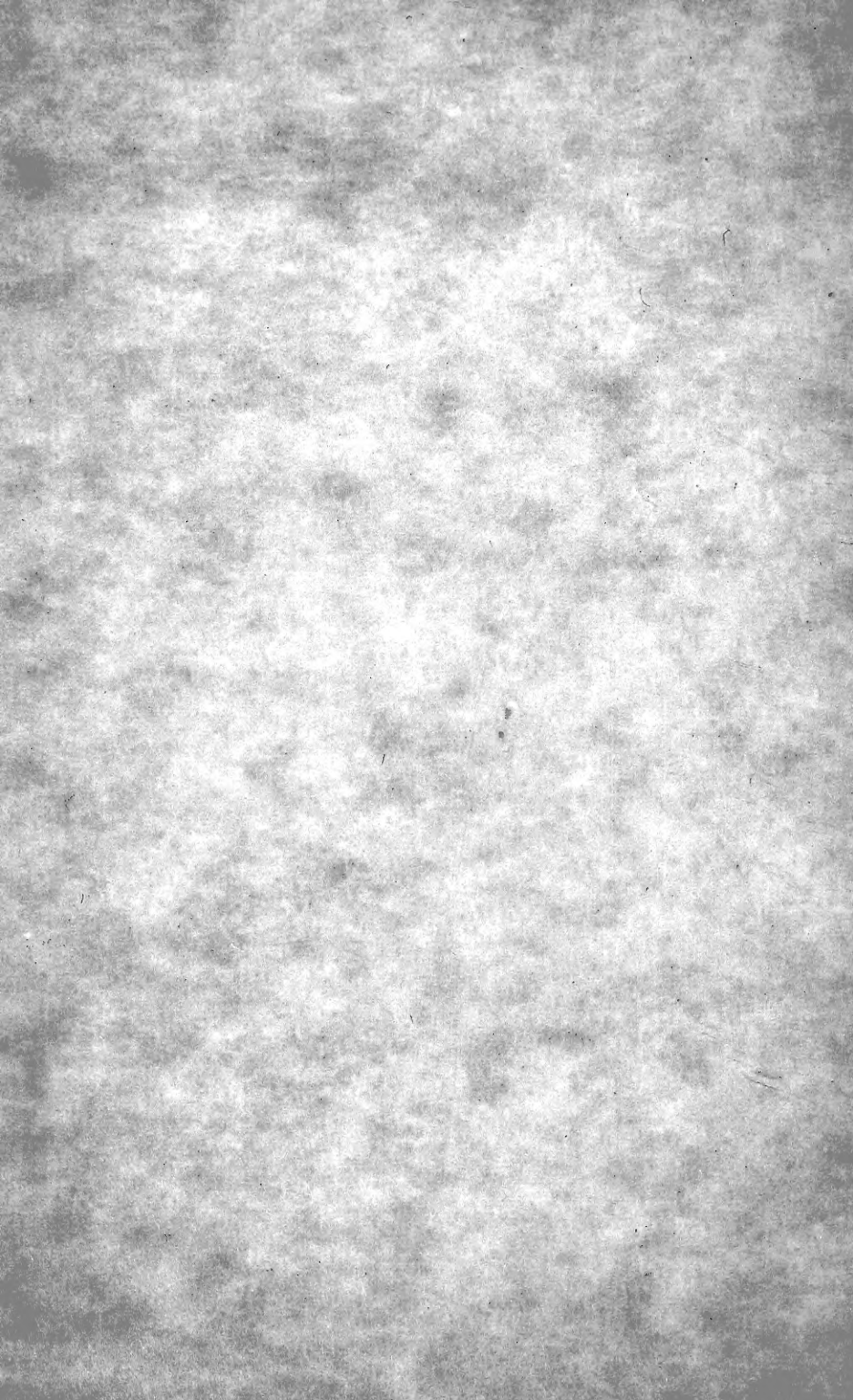
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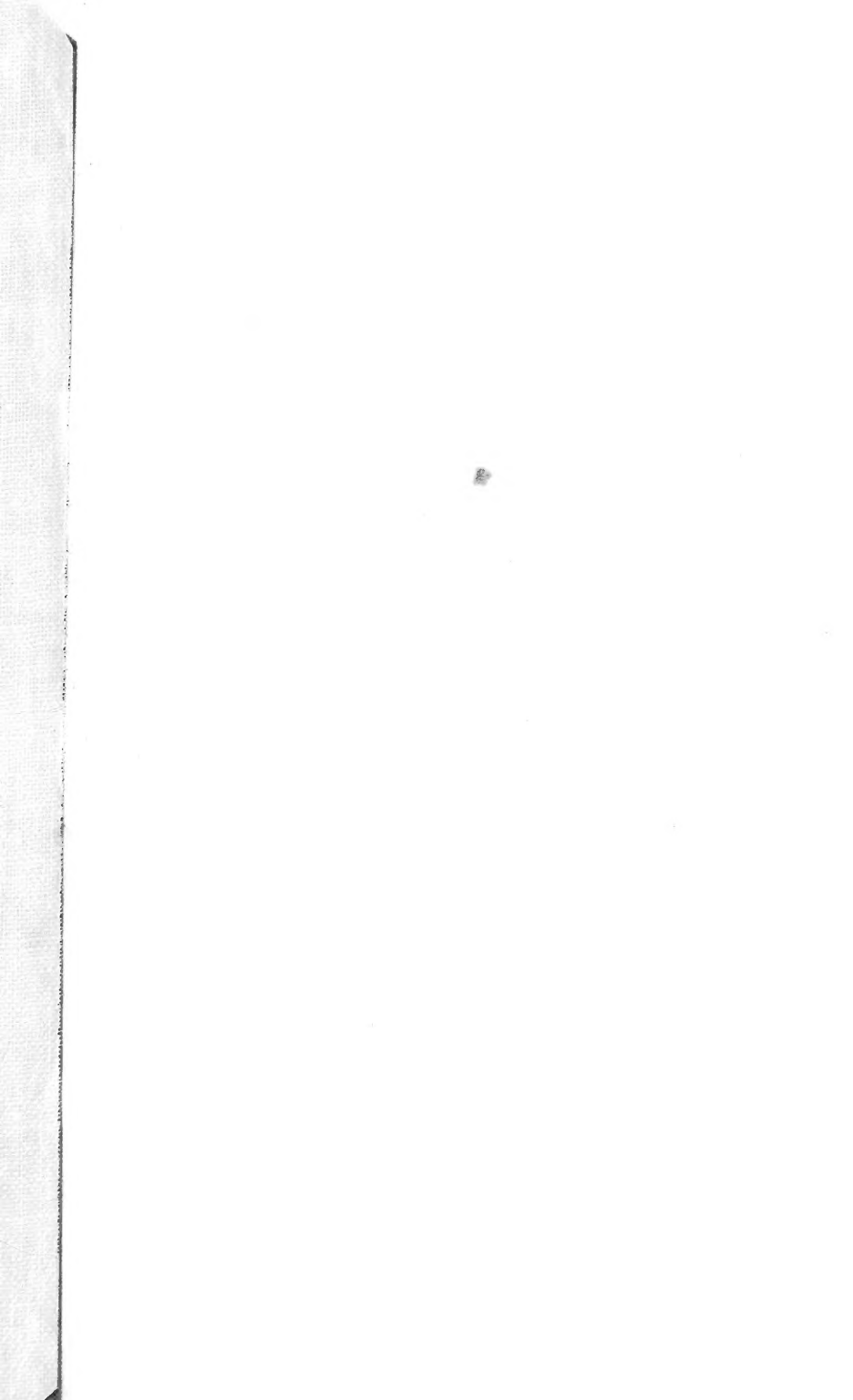
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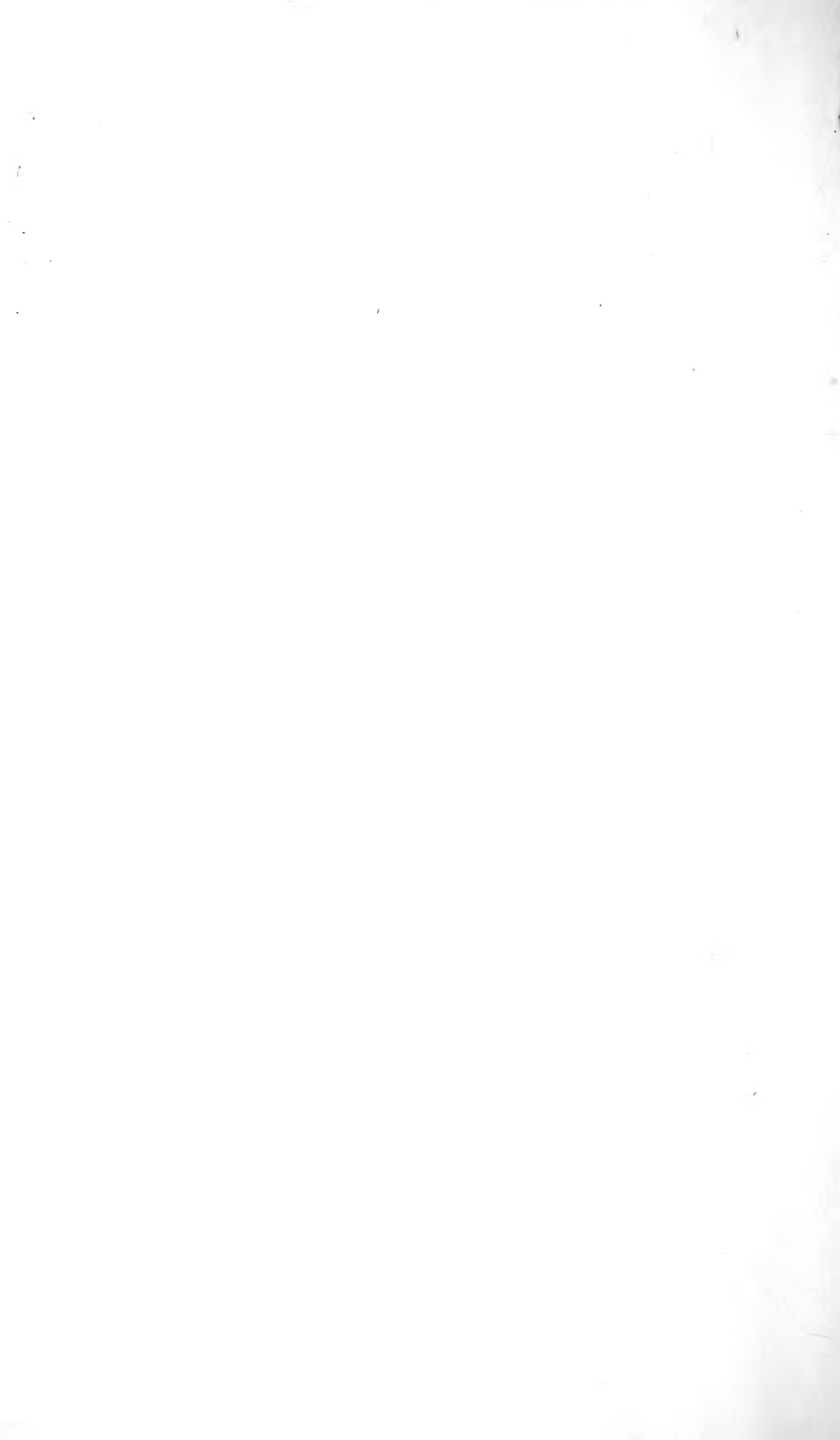
J. P. LUSE,

ON FEBRUARY 16, 1874.









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Agassiz:

The Lessons of His Life.



LECTURE,

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THE UNIVERSITY OF CHICAGO

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AGASSIZ.

A SHORT time before his death Prof. Agassiz, speaking of the laborious work of the naturalist, said, "I have devoted my whole life to the study of nature, and yet a single sentence may express all that I have done." Newton thought of himself as a child gathering shells on the ocean shore. La Place, whose learning was encyclopædic, said in his last moments, "what we do know is of small amount; what we do not know is immense." And many a brave, great heart, nearing the end, after a lifetime of intellectual labor and research, has sighed to think how scanty the result of all its toil; how vast and complex the problems, how brief the time in which to solve them. The delver into the arcana of nature is appalled as he advances, and he who goes farthest, is most oppressed with a sense of his own insignificance. Profound humility is always the result of profound research of nature, and he who stands meekest before her majesty is he who has penetrated deepest into her mystery.

The world will not accept Agassiz's estimate of his life-work. It is not necessary to indulge in fulsome eulogy, or to ignore his mistakes, to reckon him among the great. Emerson says, "I count him a great man who inhabits a higher sphere of thought, into which other men rise with labor and difficulty."

Tried by this definition, few will deny Agassiz a place among the great. Galton in his "Hereditary Genius" estimates that but two hundred and fifty men out of every million attain eminence for unquestioned, native ability. When then the volume of life of a great man is closed, it is well to study its lessons. How is the world better for

his having lived in it? By what process did he arrive at the altitude from which he shed down his light upon the undistinguished millions below? Will that light continue to cheer humanity in the generations to come, or did it dazzle but to disappoint, leaving the darkness darker? Was it an ignis fatuis, or a star, which will shine through the ages?

In view of the great space Agassiz has held for forty years in the scientific world, these questions suggest the appropriateness of some consideration of his life and its lessons. But a few weeks have passed since that busy life, twenty-seven years of which were spent among us, came suddenly to a close. His last public effort was an address before the Massachusetts State Board of Agriculture on December 2d, where we are told he spoke with "ease and unwonted energy."

Agassiz delivered his fifth lecture on the Amazon in New York on the evening of the day on which that city rendered the last honor to Prof. Bache. He opened his lecture with an earnest tribute to that distinguished man, which, without the change of a word, may now be applied to himself. Said he, "He was one of those men whom all loved who knew him; but while he was dear to his friends, he was a man of whom his country can well be proud. He has organized in these United States a work which has made science, as represented and carried on in America, respected wherever science is cultivated."

The private life and personal character, the every-day demeanor and home characteristics of Prof. Agassiz were just such as we all love to find joined to high attainments, great genius and world-wide fame. He was simple, earnest, enthusiastic, kind, genial, sympathetic, full of magnetism and boyish fervor, too great to obtrude his greatness, and too good to forget the common brotherhood of men. The trite quotation has seldom been so well applied as to him:

His life was simple, and the elements
So mixed in him that Nature might stand up
And say to all the world, This was a man.

He would not be a hero even to his own valet, if he ever had one. With the fishermen who brought him rare shells and odd fish, the farmers who consulted him about stock breeding, the puzzled, amateur naturalists who besought him for explanations, the thoughtless students who wanted hours of his precious time for elementary matters in science, he was always the kind-hearted helper, adviser, friend, knowing, as has been said of him, absolutely nothing of social distinction, and only earnest for the advancement of science and the spread of knowledge. His hold upon the popular heart was in great part due to these traits. All saw that he was not of that sort of men

whose visages

Do cream and mantel like a standing pond,
With purpose to be dressed in an opinion
Of wisdom, gravity, profound conceit.

He was accessible to all, and in that most admirably adapted to the great work of popularizing science. He was in no sense Sir Oracle ; no pompous pedant airing his erudition ; no frigid patrician shunning the common people, but an honest, great-hearted son of the Huguenots, a Swiss republican, loving the larger liberty and wider field of America. To this was due his ability, as Beecher says, to make straight the path of Tyndall, to create the demand for Huxley's lectures, and to lay the "corner-stone of our institutes of technology and scientific schools."

A marked feature of our time is the effort to popularize science. The activity displayed in it, the sudden awakening to its importance, the zeal evinced in translating to popular comprehension the abstrusest inductions, is almost as notable as the rise of criticism and the revival of learning in the sixteenth century.

Without disparagement of Gray, Youmans, Winchell, Mitchell and others, it is but justice to say that Agassiz has almost alone revolutionized public sentiment and practice in the teaching of science, and in popularizing it. The marked and eager interest of the general public in scientific subjects is in great part due to him. He worked and thought, observed and wrote, analyzed and lectured,

synthesized and spoke, for all men, of all countries, and all time. He united the philanthropist and the philosopher in that he devoted his great ability with marvelous industry to the education of the people. Most original thinkers require translators. They need to be interpreted to the common mind. Generations pass away before their ideas, discoveries, results, reach the people. Great truths have thus often lain locked up in technical or learned languages waiting for that most useful class, the middle men. Often, too, the interpreter has required to be interpreted, and the process has needed repetition many times before the mind of the first great original thinker reached that of the masses. Just as in recent years, archeologists and philologists have been forced to reach the forgotten Zend, Vedic and Cuneiform through several languages in different stages of vitality between the living tongue and the rock entombed dialects of distant ages. Agassiz was his own interpreter, and delighted to be so. He never tired in elucidating and explaining to popular comprehension facts and processes in science. His faculty that way, almost as rare as that of original research, was remarkable. His lectures are models of clearness when delivered to non-scientific audiences and the nature of the subject made popular terms possible, needing nothing of the varnish and veneer of scholarship to create interest or secure attention. In this consists one of his greatest excellencies. His thought comes to the people fresh and hot from the brain that elaborated it. It waits not for the next century for its effect. It needed not, like some of the embryos he so astonishingly investigated, to wait for a process of alternate generation, and to appear in many dissimilar puzzling forms before bursting into full and final development. In one of his books Agassiz explains to us cases in which, as he says, "the offspring not only do not resemble the parent at birth, but remain different during their whole life, so that their relationship is not apparent until a succeeding generation. The son does not resemble the father, but the grandfather; and in some cases the resemblance re-appears only at the fourth or

fifth generation, and even later. Among the Aphides it is sometimes the eight or ninth generation before the perfect animals appear again, and the original ancestor is able to recognize his descendant by any resemblance to himself." It must occur to any one that this singular process would give rise to many mistakes, both in the animal's own family and the family of scientists, awkward and inconvenient; and the fact is that naturalists in several instances have seized eagerly upon one of the intermediate descendants and have described and classified him as a separate, distinct and new animal, to their subsequent confusion and the embarrassment of entomologists and zoologists. The thought suggests itself further that possibly some one of these intermediate links might, under an evolution inspiration, set up in business for itself, and, refusing to take its absolutely necessary step around and back towards its ancestral model, start a new, odd, nondescript, unclassifiable, unscientific family of its own, in contempt of Cuvier, Linnaeus and Von Baer, and in reckless disregard of the abolished number sixth, seventh, or eighth animal which, by this erratic behavior, never had a chance to enjoy its hour life of sunlight. Some such peril as this does the ultra-technical scientist undergo. Agassiz avoided it by his clear comprehension of the popular mind; his remarkable faculty for elucidating the abstrusest subjects, and his scorn of pedantry. Here is one of the lessons of his life—a lesson for thinkers—a lesson for the privileged few who walk upon the mountain tops of thought—a lesson, too, for educated men on a lower plateau, who yet overlook the great plains wherein crowd and swarm the multitude waiting for signals, for men of education and culture stand as did the trusted signal keepers two or three centuries ago on the coast of England. It was their duty, watching on the hill tops, to kindle great fires on the approach seaward of a strange fleet, thus warning the country inland, which sent on and on the warning, till it reached the whole island, when the dwellers in valleys and lowlands were as well informed as those on the coast and mountains.

In Agassiz's life of sixty-seven years, one trait that cannot fail to strike us is his persistent cultivation of the homely old virtue of industry. In this he was not excelled by Humboldt, Cuvier, or Franklin. Who has ever reached eminence in the field of science without it? How often does close examination prove that, after all, a great reputation is due more to honest, persistent, hard work than any special talent or genius. We so like to picture the hero and demigod in man that we are prone to forget the scholar in his long vigils, the student in his years of silent toil up the steep and rugged ascent, preferring to believe that genius at a bound compassed the long road and the lofty eminence. The fact is the hardest workers are men like Agassiz, driven through life by an enthusiasm that will suffer no rest, and, too often, like him into an untimely grave, sustained only by an undying and sleepless love of truth, coupled with a desire to leave the world better for having lived in it. To his students he said, "It must not discourage us, that the process of microscopic examination is a slow and laborious one, and the results of one life-time after all very small." In one of his lectures on classification of animals he says, "In one instance I had an ovarian egg of a white fish for sixty-three consecutive days, daily for several hours under the microscope, following without interruption all its changes till the fish was hatched." Is it any wonder that he died with a mortgage on his house? Think of such a man, with such an eye, and such a brain behind it, watching a minute fish egg through a microscope for over two months—long enough time to have made forty able political speeches. Such men are driven to their work by a quenchless thirst for knowledge almost incomprehensible to ordinary mortals. Most of us are content to think with Dean Swift that a flea

Has smaller fleas that on him prey:
And these have smaller still to bite 'em,
And so proceed *ad infinitum*.

We take our knowledge of natural history, microscopy and the underworld at second hand, but Agassiz saw gran-

deur and sublimity even in an ovarian egg scarcely perceptible to the naked eye. Hear him on microscopic examination of the formation of an ovarian egg: "The process," he says, "is very difficult to follow, and in watching it one is reminded of what astronomers tell us of distant bodies in space, which, when observed with the highest magnifying power, appear only like irregular clouds of dust, while others are circumscribed in definite areas, and seem more like nearer celestial bodies with which we are familiar. We deal, as it were, with the nebular world of animal structures. The mysteries of cell formation are indeed as difficult to trace as the nebulae of the astronomer." And again in his "Method of study of Natural History" he says, "One can hardly conceive the beauty of the egg as seen through the microscope at this period of its growth, (the first change) when the yolk is divided, with the dark granules on one side: while the other side, where the transparent halo of the vesicle is seen, is brilliant with light. With the growth of the egg these granules enlarge, become more distinct, and under the microscope some of them appear to be hollow. They are not round in form, but rather irregular, and under the effect of light they are exceedingly brilliant. Presently, instead of being scattered equally over the space they occupy, they form clusters,—constellations, as it were,—and between these clusters are clear spaces produced by the separation of albumen from the oil. At this period of its growth there is a wonderful resemblance between the appearance of the egg, as seen under the microscope and the firmament with the celestial bodies. The little clusters or constellations are unequally divided. Here and there they are two and two like double stars, or sometimes in threes or fives, or in sevens, recalling the Pleiades; and the clear albumen tracks between are like the empty spaces separating the stars."

The Pleiades in an ovarian turtle egg, not larger than a pin's head! There are people who can

Gaze upon those isles of light
So wildly, spiritually bright,

yet see no sublimity in the firmament with its "patines of bright gold." Such are not expected to appreciate the exacting labors, the enthusiasm, nor the sense of beauty of the philosopher who sees in a minute spherule the orderly march of the starry hosts, who hears in its tiny cell a music akin to that of the spheres, and who bows earnestly before the sublime mystery of creation, whether dimly hinted in a microscopic vesicle or grandly displayed in heaven's "majestical roof, fretted with golden fire."

A philosopher of our day affirms that "the reputations of the nineteenth century will one day be quoted to prove its barbarism." If so, that of Agassiz will not be omitted. When he came among us twenty-seven years ago the American Journal of Science says "this country was without a museum of Natural History, a Zoological laboratory, or a well organized scientific school, and of course without the interest necessary to establish them, and hence, as the next century may say, was barbarous. The tireless industry of Agassiz was not confined to Embryology, "The huge Ammonites and first bones of time" equally elicited his enthusiasm and his genius. His activity was wonderful. After scouring Europe for proofs of the glacial theory which he developed, and which required research and observation totally different from, and unlike, that just referred to, he sailed for America. He said somewhat naively. "In 1846 I came to this continent, and the first walk I took in Nova Scotia, a few hours after the arrival of the steamer on which I was a passenger, at Halifax, I saw the well known tracks of glacier marks all over the hills." His recreation was research. That first walk over the hills of Nova Scotia was the commencement of tours which encompassed the continent. Along the coast of North America, in the Lake Superior region, up the Amazon, around the Cape, along the South Pacific coast, into the Golden Horn, and across the continent that never resting, indefatigable, ever buoyant, and always genial student of nature went, ever

Hammering and clinking, chattering stony names
Of shale, and hornblend, rag, and trap and tuff
Amygdaloid and trachyte.

His "Contributions to the Natural History of the United States," in four large volumes, are a monument of his industry, his accuracy of observation, and vast range of scientific knowledge, in which the young men of this and after time may see written admonition and encouragement to high endeavor and lofty purpose. They "are foot-prints in the sands of time" which the tide of centuries in their ebb and flow may not erase, but the impression deeper make, reminding the struggling and aspiring however hard the road and long the way, we can "make our lives sublime."

The limits of a lecture would scarcely suffice for a brief mention of the writings of Agassiz. Several works written in Europe on the glacial theory and that on fossil fishes, which Humboldt calls a masterly work, have never yet been translated. His monographs, lectures, addresses, magazine articles, are very numerous, and yet he found time for his larger works, for scientific excursions, for lectures, teaching, laboratory work and long microscopic investigations. His mental activity unquestionably hastened his death, otherwise he might have lived as long as Humboldt, and at ninety continued to turn the leaves of the great open book of nature. Yet, like Goethe, he thought "a useless life an early death," and compared with common men he lived for centuries. In a letter to Prof. Silliman, before he came to this country, he said "My sphere is entirely circumscribed by the scientific world, and all my ambition is limited to being useful to the branch of science which I particularly cultivate." The key to his after life is in this sentence. He was no book-worm, no closet student, no reclusé scholar, no aristocrat in science, delving and digging for the selfish love of that occupation. Nor was he a one-ideal enthusiast chasing a pet theory into a hole and there nursing it lest others should claim it. Usefulness to science and thus to all mankind expressed his full ambition and ennobled his whole life. He aptly expressed in one of his books his idea of the sphere of purely scientific men and the duty of the public towards them in these words: "Let me say

that the community should foster the purely intellectual efforts of scientific men as carefully as they do their elementary schools and their practical institutions, generally considered so much more useful and important to the public. For from what other source shall we derive the higher results that are gradually woven into the practical resources of our life, except from the researches of those very men who study science, not for its uses, *but for its truth*. It is this that gives it its noblest interest: it must be for truth's sake, and not even for the sake of its usefulness to humanity, that the scientific man studies nature. The application of science to the useful arts requires other abilities, other qualities, other tools than his; and therefore I say that the man of science who follows his studies into their practical application is false to his calling. The practical man ever stands ready to take up the work where the scientific man leaves it, and to adapt it to the material wants and uses of daily life."

In that splendid series of lectures which Prof. Tyn-dall delivered in this country he expressed the same idea. He said "There are joys of the intellect as well as joys of the body. These pleasures of the spirit constituted the reward of our great investigators. Led on by the whisperings of natural truth, through pain and self-denial, they often pursued their work. With the ruling passion strong in death, some of them, when no longer able to hold a pen, dictated to their friends the results of their labors, and then rested from them forever.

Could we have seen these men at work without any knowledge of the consequences of their work, what should we have thought of them? To many of their cotemporaries it would have appeared simply ridiculous to see men whose names are now stars in the firmament of science straining their attention to observe an effect of experiment almost too minute for detection. To the uninitiated, they might well appear as big children playing with not very amusing toys. It is so to this hour. Could you watch the true investigator—your Henry or your Draper, for example—in his laboratory, unless animated by his spirits, you

could hardly understand what keeps him there. Many of the objects which rivet his attention might appear to you utterly trivial ; and, if you were to step forward and ask him what is the use of his work, the chances are that you would confound him. He might not be able to express the use of it in intelligible terms. He might not be able to assure you that it will put a dollar into the pocket of any human being living or to come. That scientific discovery may put not only dollars into the pockets of individuals, but millions into the exchequers of nations, the history of science amply proves ; but the hope of its doing so is not the motive power of the investigator. It never can be his motive power."

This high idea of the dignity of the scientific vocation is as yet not fully comprehended in our country, and hence such really rare men as Kirkwood, the astronomer, who has across the sea been termed "the Kepler of America," is forced to earn a beggarly salary by elementary teaching in a western college, though his fine abilities and extraordinary acquirements are needed in a much wider field. He has been taught the bitter lesson which Agassiz early learned when he said before coming to America, "I learned early that, where one has no fortune, one cannot serve science and at the same time live in the world." All honor to the noble men of Boston who enabled him to live in the world, and for it.

The men who, often in obloquy and poverty, discover through difficult, intricate, and laborious processes great laws of nature, are seldom rewarded while living, their monuments and their fame rising only when they have passed away. The real pioneers but "blaze the way," to use a frontier expression. When a McAdamized road is built, and all the world is pleasantly traveling over it, their dangers and labors are forgotten. There is no preferred stock for them. and in declaring dividends they are not included. Patents are not granted to, nor privileges conferred on, men who spend their lives in microscopic examination of infusoria, in dissecting animals, resolving nebulae or watching comets. As Prof. Youmans has said "The devotion

of men of science to the study of Nature is still a popular puzzle. It is not yet looked upon as the highest occupation of the human mind to extend our knowledge of the order of things around us. On the part of classes still called educated there exists an ill-concealed contempt for the mental pursuits of mere collectors, observers and experimenters. It is not now so bad as when in England Lady Granville's will was attempted to be set aside on the ground of lunacy, evinced by no other evidence than a fondness for collecting insects: yet enthusiastic naturalists who ransack field and forest, mountain and sea, are still regarded as a class apart—as eccentric objects of curiosity, not to be compared in dignity with the students of art, literature and metaphysics. So much of the old spirit continues that, as objects of thought and in the education of to-day, the works of man are ranked as superior to the works of God. Nor is it by any means considered so very desirable to know all about nature. Large numbers of the cultivators of sentimental literature still protest that if the world were once understood, it would no longer be worth living in. The heads of college-bred people are still filled with the old childish fictions which are fondly cherished, and science, because it would clear away the mountains of this rubbish, in which the seekers after a liberal education are still made to delve, is dreaded as a desolating agency that would bereave us of all that is most ennobling and refining in culture." Of the scientist too many are yet apt to say that

Whether he measure earth, compute the sea,
Weigh sunbeams, carve a fly, or split a flea :
The solemn trifter with his boasted skill
Toils much, and is a solemn trifter still.

The author of *Hudibras* wrote a satire on the Royal Society, notwithstanding Newton was a member, and submitted the *Principia* to it, entitled the Elephant in the Moon. This was two hundred years ago, and long before that solemn body, the Pickwick Club, yet burlesque as it is, it still to a large extent represents the popular idea of the scientist's vocation, his mishaps and blunders.

Agassiz's classical learning was something more than

rubbish, for in one of his lectures "on the affinities of animal life," he makes the following statement: "Aristotle knew more of certain kinds of animals and their general relations than is known now. Strange to say I have studied the Selacians on the South American coast by the light of Aristotle's researches upon them in the Mediterranean Sea made by him more than 2000 years ago. I can fairly add that the knowledge of Aristotle on these topics is so far ahead of the current information recorded in modern works of natural history that his statements can only be understood by one who has made a special study of these animals. I wish I could handle my subject with Aristotle's mastery." In the battle raging between the advocates of classical and scientific education this information may operate to some extent as an argument for truce and compromise, for here is common ground, a *zona libra*—on which both can stand.

A late writer says of Agassiz, "Not this nation only, but the world, has suffered a great loss. More than any man since Cuvier and Von Humboldt, has he been known over the whole world. His fame arose alike from the great number and value of his original investigations and publications, from his ability as a philosopher and from his power of inspiring others with his own enthusiasm.

The mention of Humboldt's name recalls the fact that to him we are indebted for Agassiz, who said "he (Humboldt) has always treated me as a friend, and his good counsels have been to me like those of a father." Thus the debt America and the world owes the great German philosopher is doubled and will go on increasing with compound interest for many centuries, for through Agassiz to Humboldt we owe the many younger scientists now in the field and the wonderful scientific interest now exhibited in the country. There was much in the characteristics of the two men and their lives alike. In dauntless courage and indefatigable energy, wide scope of learning, great ability in generalizing, and acuteness of observation,—in willingness to learn from any source and anxiety to impart their knowledge—in the humility of vast

acquirements, in geniality of social intercourse, in utter carelessness for material gain and indifference to political preferment, or anything that by any possibility could interfere with devotion to science, they were counterparts. Beautiful is the friendship of such men. It was Humboldt who proposed to the king of Prussia to give Agassiz the necessary funds for a two year's journey on this continent. It was through Humboldt's influence that the king, as Agassiz said, "granted in a most generous manner a sum sufficient for the journey." In Agassiz's address at the Humboldt Centennial in Boston, in simple and touching words he again acknowledged his debt of gratitude to Humboldt. He said "His sympathy for all young students of nature was one of the noblest traits of his long life. It may truly be said that towards the close of his career, there was hardly one prominent or aspiring scientific man in the world who was not under some obligations to him. His sympathy touched not only the work of those in whom he was interested, but extended also to their material wants and embarrassments. At this period I was twenty-four, he was sixty-two. I had recently taken my degree of Doctor of Medicine, and was struggling not only for a scientific position but for the means of existence also. I have said that he gave me permission to come as often as I pleased to his room, opening to me freely the inestimable advantages which intercourse with such a man gave to a young investigator like myself. But he did far more than this. Occupied and surrounded as he was, he sought me out in my lodgings. It was no doubt apparent to him that I was not familiar with the good things of this world, for shortly afterward I received an invitation to meet him at one of those restaurants, the tempting windows of which I had occasionally passed by. For three hours which passed like a dream, I had him all to myself. How he examined me, and how much I learned in that short time! How to work, what to do, and what to avoid: how to live, how to distribute my time, what methods of study to pursue, these were the things of which he talked to me

in that delightful evening. It was not enough for him to cheer and stimulate the student. He cared also to give a rare indulgence to a young man who could allow himself few luxuries." Hammerton has well said "The Humboldts never are too rich : they possess their gold and are not possessed by it."

Agassiz's words, recalled now, shed lustre on the memory of two of nature's noblemen. He continued to pay his debt of gratitude in benefactions to struggling students down to the day of his death. In a lecture delivered by Prof. Wilder of Cornell University before the American Institute on "Brain and Mind," he went somewhat aside to speak thus of Agassiz: "His head is large, and his brain may be as big as Cuvier's—(long may we wait in ignorance as to that); but whether it is or not, shall we credit a mass of nervous matter with the influence this whole nation has felt from his enthusiasm and devotion to science? What is it that has made him perform an amount of intellectual labor that would kill two ordinary men, and has, in fact, nearly killed him; which has then led him to forego the increase of his own fame at a most critical period in scientific progress, and give his energies to establish a museum whose magnificent collections are free to any young naturalist who proves his power to use them for the advancement of science; which has made him, year after year, a beggar for means to carry on this museum and pay the workers therein, yet receive not a dollar for his own services; which has caused him, though poor himself, never to accept a single cent for tuition from the scores of young naturalists who owe their training to him; and which, if I may add my personal testimony to the general stock, has actuated him in previous years for the investigation of a group of animals which had an especial interest for him, to appropriate that which he had received for public lectures, and then to lead me into paths promising far more benefit to me than to his own work; and now to set apart a liberal sum from the museum funds to bring together a collection, the scientific results of which are to belong to me and to me alone;

so that I have to thank him, not only for a material, but for an intellectual, income. What is the spirit which has inspired all these things, and which bring not only admiration but love? Is it a matter of cells and fibers; of fat and phosphorous; of many and deep cerebral convolutions? God forbid the thought. Rather let us believe that when the heart shall have ceased to beat, and the brain to suffer its molecular changes, the same great mind will then, as now, and in Heaven as upon earth, pursue the study of spiritual creatures, and direct less gifted ones into the paths which have already led him to the loftiest view of Nature and of Nature's God." Alas! the great brain of the naturalist has been weighed, although a year had not passed since these words were spoken. The weight of his life-work will not be known till many generations have passed away.

Another student says that "Whenever he saw a student who would study nature, he opened the way for him, took him into the laboratory, opened his treasures before him and directed his studies, and this too without any expectation or thought of a pecuniary reward as a return. I do not know of a single student who ever paid him a dollar as a tuition for his instruction in natural history studies. Young men came and staid and studied as long as they would, and, as far as tuition was concerned, without money and without price." It is from such sources that we get the most accurate idea of the real man. We fondly linger over these personal reminiscences because, as has been said, "good men make the earth wholesome."

It is interesting to know that notwithstanding this ever open-hearted generosity he suffered no small privations. When he came to America he was laboring under a debt of \$20,000, incurred by the financial embarrassment of a friend who was engaged with him in publishing his great work on Fossil Fishes. After his release from his engagement by the Prussian Government, he accepted a professorship at Cambridge at \$1500 per year. Dr. Loring says of him, "He then commenced his labors at Cambridge—labors which he has never discontinued, un-

less checked by ill-health and foreign investigations ;— casting aside the privileges offered him by Mr. Lawrence, and devoting himself to the hard work of the professorship in the lecture-room. Meantime, owing to his small salary, and the heavy load of debt which pressed upon him, he was obliged to give public lectures constantly, traveling for that purpose during the intervals of his college course. Commencing his college lectures without specimens for illustration, he taxed himself to the utmost to defray the expenses of securing them. Worn out in health and exhausted in purse by this constant drain upon both, in his untiring labors, he established a female school in his own house, hoping in that way to meet his family expenses and the constantly increasing cost of his scientific lectures. The munificent donation of \$50,000 by the Hon. Francis C. Gray, and the grant of \$100,000 by the State, with the outlay of \$10,000 by Agassiz himself, from his own purse, gave the museum its first foundation ; and to this work Agassiz has devoted himself from choice and attachment to our country, and not from necessity. During the darkest days of his labors, when the difficulties of his scientific position were the heaviest, he received an earnest invitation to the *Jardin des Plantes*, as he did various other offers to return to Europe, and a strong request to unite himself with the University of California, at a salary of \$20,000 per year. He was never tempted, however. He felt that he had here commenced a work which was to be the success or failure of his whole life. He was completely identified with it."

Writing of the laborious work of microscopy Agassiz said " I think people are not generally aware of the difficulties of microscopic observation, or the amount of painful preparation required to fit the organs of sight and touch for the work. In old times men prepared themselves with toil and vigil for entrance into the temple : and nature does not open her sanctuary without exacting due penance from her votaries. It seems an easy matter for a man to sit down and look at objects through a glass which enlarges

everything to his vision ; but there are subjects of microscopic research so obscure that the student must observe a special diet before undertaking his investigation, in order that not even the beating of his arteries may disturb the steadiness of his gaze, and the condition of his nervous system be so calm that his whole figure will remain for hours in rigid obedience to his fixed and concentrated gaze."

No special diet has ever been discovered that will keep steady the nerves of a scientist or theologian when the doctrine of evolution is broached. Not

Mandragora nor all the drowsy syrups in the world

are able to repress the uproar that ensues in almost any organization when this apple of discord is introduced. Agassiz persistently and emphatically opposed Darwinism, in his last published article reiterating with increased fervor his arguments against it. In that he said "How the world originated is the great question, and Darwin's theory, like all other attempts to explain the origin of life, is thus far merely conjectural. I believe he has not even made the best conjecture possible in the present state of our knowledge." For his opinion on this vexed question Agassiz incurred nearly all the censure to which he was ever subjected, yet it must be remembered that even Darwin spoke of him as his "most courteous and most formidable opponent." Prof. Fiske, of Harvard, in a late article on Agassiz and Darwinism, declares that Agassiz is no more competent to grapple with the theorems of Darwin than a child is qualified for improving the methods of the integral calculus." He thinks Agassiz was "hopelessly behind the age" and never knew what the Darwinian theory is. He attributes this to that "rigidity of mind which prevents the thorough revising of our opinions and which is sure, sooner or later, to come upon all of us, and which we ought to dread as we dread the stagnation of old age or death." He affirms that Agassiz's mind acquired that rigidity before Darwinism began to occupy the attention of earnest thinkers. But in this very article its author says "on evolution my mind

was so thoroughly made up thirteen years ago, that the discussion of it, as ordinarily conducted, has long since ceased to have any interest for me. I am just as firmly convinced that the human race is descended from lower animal forms, as I am that the earth revolves in an elliptical orbit about the sun." How strange that this author never thinks of his own "rigidity of mind," so evidently indicated here. "He that is giddy, thinks the world turns round."

The golden rule of our great American botanist, Prof. Gray, is that upon which the thoughtful will act for many years yet on the question of evolution. He thinks that "Upon very many questions a truly wise man remains long in a state of neither belief nor unbelief, but your short-sighted man is apt to be preternaturally clear-sighted, and to find his way very rapidly to one or the other side of every mooted question." The judicial impartiality of Agassiz's mind is evident in almost every sentence he utters. His admonitions to patient and thorough investigation, careful induction and fearless conclusion appear constantly. "He said, 'It is a part of true culture to refrain from judgment and from expression of opinion where observation fails us. What we seek may, perhaps, only be ascertained when better observers and better appliances for observation are secured.'" If "Agassiz's repugnance to Darwinism grew in great part from his apprehension of its atheistical tendency," as has been said, he fought it by scientific, not theological, methods. He accepted the views of Herbert Spencer when he said "Fearless inquiry tends continually to give a firmer basis to all true religion. The timid sectarian, alarmed at the progress of knowledge, obliged to abandon one by one the superstitions of his ancestors, and daily finding his cherished beliefs more and more shaken, secretly fears that all things may some day be explained, and has a corresponding dread of science: thus evincing the profoundest of all infidelity—the fear lest the truth be bad. On the other hand the sincere man of science, content to follow wherever the evidence leads him, becomes by each new

inquiry more profoundly convinced that the universe is an unsolvable problem."

The deep religious nature of Agassiz continually appears in his writings. He said of Humboldt, who was accused of scepticism, "A reverential spirit for everything great and good breathes through all his pages:"—a remark equally applicable to his own. If its true that "an undevout astronomer is mad" as Young said, it is equally true of sciences that came later and lead up, as Agassiz has expressed it, to an "acquaintance with the ideas of God himself."

To his religious spirit was joined the widest and most liberal tolerance. In his lecture on "Men and Monkeys" he said, "It is no longer possible for any man, or any set of men, to assume that the truth is in them exclusively. Men have learned that there is only one common foundation for their beliefs, however they may differ from one another in their religious principles. Men have learned that there is only one source for their knowledge, which is nature, however much they may differ in their interpretation of nature's facts. There are different denominations among Christians, and no one has a right to present his view of the subject as the only correct one."

Prof. Fiske says that "Agassiz had become the welcome ally of those zealous but narrow minded theologians, in whom the rapid progress of the Darwinian theory has awakened the totally groundless fear that the necessary foundations of true religion, or true christianity, are imperiled." If Agassiz was the ally of the anti-Darwinians he had become such from patient scientific investigation according to scientific processes. He was not of that class of men who

Prove their doctrine's orthodox
By apostolic blows and knocks.

He had "that intellectual fearlessness which accepts a proved fact without reference to its personal or social consequences," and he believed with the author of "The Intellectual Life" that "the plain course for the preservation of our honesty, which is the basis of truly intellectual think-

ing, is to receive the truth, whether agreeable or the contrary, with all its train of consequences, however repulsive or discouraging." He had himself been the victim of religious intolerance and bigotry. In one of his lectures on the "Method of Creation," he said, "When science was raised above contempt, she became the object of a dread almost fatal to free development. Her boundaries were prescribed by theology and limited by the generally accepted creeds. Indeed this phase of persecution has hardly yet passed away. I remember well, when a young man, being called before the Board of Education of Neuchâtel, the town where I then taught as professor, to be reprimanded for inculcating infidel doctrines: and this because I did not hesitate to speak of geology as revealing, approximately at least, the age of the world, and showing it to be far older than church creeds had supposed."

Agassiz before this little board of bigots reminds us of Galileo in penitential garb before the Pope begging pardon for the sin of proving that the earth moved around the sun. It recalls Bruno flying from kingdom to kingdom, seeking safety for a similar heresy—caught at last and paying for the great crime of Astronomy by death at the stake. He was burnt at Rome, February 16, A. D. 1600, two hundred and seventy-four years ago to-day, a victim of religious intolerance, a martyr to truth. A historian says that "with both present and prophetic truth he nobly responded, when the atrocious sentence was passed upon him: 'Perhaps it is with greater fear that ye pass this sentence upon me than I receive it.' " Science canonizes no saints and makes no pilgrimages, but in view of the perfect establishment of the truths for which Rome burnt Bruno, its devotees might without much superstition believe that, as was said of another martyr, his ashes were cast into the Tiber, which bore them to the Tuscan Sea and the Tuscan Sea carried them to the wide Ocean, so that his ashes like his doctrines might be scattered over the whole world.

Agassiz's arrest also suggests Columbus before the congregated wisdom of the fifteenth century at Salaman-

ca, solemnly admonished to give over the infidel notion that the earth is round, notwithstanding his vow to make a pilgrimage to Jerusalem and devote a portion of his expected gain from new discoveries to restoring the Holy City to Mother Church.

Science has been forced to fight nearly every step of its glorious march against bigotry, prejudice and intolerance. It has always been compelled to camp on the field and to sleep on its arms since that grand awakening in the sixteenth century when, Draper says, "On the ruins of its ivy-grown cathedrals, Ecclesiasticism surprised and blinded by the breaking day, sat solemnly blinking at the light and life about it, absorbed in the recollection of the night that has passed, dreaming of new phantoms and delusions in its wished for return, and vindictively striking its talons at any derisive assailant who approached too near."

Agassiz incurred the imputation of Atheism in a more notable instance that he has mentioned; this by his theory of the multiple origin of the human race, which he defended in an essay prefixed to Nott and Gliddin's "Types of Mankind. He said, "there is no evidence whatever for the assumption that mankind originated from a common stock and that all the different races with their peculiarities, in their present distribution, are to be ascribed to subsequent changes." Yet he thought that "all our liberty and moral responsibility, however spontaneous are yet instinctively directed by the All-wise and Omnipotent, to fulfil the great harmonies established in nature."

In view of Agassiz's position on the three subjects, the age of the earth, the multiple origin of the human race and evolution, he has been spoken of by one class as an "irreligious scientist," by another as a "scientific religionist," accordingly as the speaker adapted his science to his religion or his religion to his science. He deserved neither epithet. An earnest, yet fearless, student of nature, he followed reverently her teachings, and going to the limit of established law waited patiently, hopefully,

confidently for more light. When centuries ago navigation extended not beyond the pillars of Hercules, coin of that time was stamped with the words "*Ne Plus Ultra*." When the Antilles were discovered the word "*Ne*" was stricken off, and the inscription read "*Plus Ultra*," and the world waited for the "More Beyond." This hemisphere has justified that faith. Agassiz stood upon an outlook few men ever reach, and peering into the unknown waited meekly, yet confidently for the "More Beyond." Can we not all agree with Draper, who thought that, "Man however learned and pious he may be, is not always a reliable interpreter of the ways of God. In deciding whether any philosophical doctrine is consistent or inconsistent with the Divine attributes, we are too prone to judge of those attributes by our own finite and imperfect standard, forgetting that the only test to which we ought to resort is the ascertainment if the doctrine be true. If it be true, it is in unison with God." Eminent scientists have not always accepted this rule, for Prof. Tyndall says "In one of my latest conversations with Sir David Brewster he said to me that his chief objection to the undulatory theory of light was that he could not think the Creator guilty of so clumsy a contrivance as the filling of space with ether in order to produce light. This, I may say, is very dangerous ground, and the quarrel of science with Sir David, as with many other persons, is that they profess to know too much about the mind of the Creator." La Place was convinced that if the Almighty had made the moon he would have placed it much farther away from the earth, and otherwise changed its relation to this planet. A more modern philosopher has discovered in the defects of the eye sufficient evidence that the All-wise optician had nothing to do in its construction.

In his antiquity of man Lyell quotes a saying of Agassiz that tersely exhibits the progress of science. He said that whenever a new and startling fact is brought to light in science, people first say "it is not true," then "that it is contrary to religion," and lastly, "that everybody knew it before." From the ancient days when it

was sinful not to believe the earth a flat plain and the sky a crystalline dome resting over it down to Darwin's Descent of Man, this has been the history of nearly every great scientific discovery. There are eminent Christian scholars who accept the doctrine of evolution, and others who like Dr. McCosh and Dr. Peabody think Christianity has no vital interest in the question. In view of the fact that Christianity has survived the failure of infallible bulls to banish comets and abolish the heliocentric theory, and to arrest nearly every great advance made by science in our knowledge of the laws of nature, it is not unreasonable to think that it may continue to exist whether Darwinianism finally takes rank with the law of gravitation, or is consigned, as many visionary hypotheses have been, to the great lumber rooms of the past. Writing of Agassiz sixteen years ago, Whipple said that he "overcame a temptation, rather than yielded to one, when he broke through the technical limitations of his science and passed from laws to ideas, and from ideas to God. The fear of rousing theological prejudice is not the kind of fear a man of science is now in most danger of regarding. He is more tempted to yield to that refined form of cowardice which makes him apprehensive of offending the prejudices of his order. A theological leaning in his scientific speculations is likely to expose him to the suspicions of his peers in science and withdraw from him the signs of that subtle free-masonry by which leading minds recognize each other." "There is nothing," said Montaigne, "that I fear so much as fear." The higher kind of courage implied in this Agassiz had. In the instance heretofore referred to, he was, as one of his friends said, "honored with a howl of execration from that large body of persons who suppose that religion is only safe when it is under the guardianship of ignorance and unreason." Later the howls changed to cheers and he was proclaimed the "welcome ally of zealous and narrow minded theologians." Had he accepted Darwinism, his fame probably would have been greater with that class of people who claim to be "advanced thinkers," especially in the

United States, Germany and England, for in these countries many of the leading scientists have adopted the theory of evolution. Lyell, Huxley, Wallace, Lubbock, Vogt, Haeckel, Gray, Draper, Wyman and scores of others as eminent are Darwinists.

In England, recently, Agassiz has been spoken of as a "mere specialist," and in this country he has been the subject of sympathy for "rigidity of mind which prevented him revising his opinions."

There was a time in France when men of science considered belief in God the mark of a vulgar mind, and when, as has been said, "infidelity was prattled by fops just as superstition was prattled by devotees." There yet exists something of that spirit—a relic of the intolerance of the Middle Ages. There is a bigotry in science as well as in religion. Many there yet are, even among the educated, who upon the announcement of a startling discovery, the upturning of some old superstition, the proclamation of a new and plausible theory rush to cry

Eureka, it is clear

When but some false mirage rises near.

In its advance, science like an army leaves its worn out material behind it, and here and there a lame veteran, too old and stiff to keep up with the rear guard, who once marched at the very head of the column. The Ptolmaic theory was better than Atlas with his broad shoulders standing upon the back of a turtle which floated on a shoreless ocean. But Copernicus struggled to the front after great labor and Ptolmey fell behind. It was better to have the sun in the centre of our solar system than the earth, even though Copernicus had all the planets moving in circular, instead of elliptical, orbits. Kepler pushed ahead of Copernicus, then fell behind Newton, and even Newton made mistakes which later workers have corrected. So science advances. Each builder lays his course in a tower for all the world to look at in after times, but each in his negligence or ignorance leaves his unused stone and mortar for the next to clear away,—his faults of unskillful or hasty workmanship for the next to repair

before he proceeds with his course. But the tower still rises, and already the morning sun gilds its topmost layer with the glory of a grander civilization than earth has ever known, sustained by true science and ennobled by free religion. It will yet higher rise for no Babel tower is this, even though dogmatists in theology or science howl and chatter about its base in all the jargons known to philology or commerce ;—slowly, it may be, as the islands rose out of the sea in the upheaval's geology tells of—yet as surely ; and ages hence no doubt marine fossils will be found upon its top, and clinging to its sides, far above their native beds. The use of fossils is one of the most fortunate discoveries of our era,—thanks to da Vinci and Lamark. Many a mollusk and many a man has been of great service in that shape, whose particular object in existence had previously been a profound mystery.

We glory in the advance of science and we glorify ourselves thereat, prone to forget the numerous fanciful, plausible, yet preposterous hypotheses which learning has introduced into the world ;—which have lived out a generation, been condemned, consigned to unhonored graves and forgotten. All the patent offices and museums of the world would not hold the models of abandoned and exploded theories which promised to immortalize their authors and revolutionize the nations. All of his knowledge did not prevent Liebnitz, the great physicist and mathematician, from trying to form an universal alphabet with algebraic signs instead of syllables and words. The philosopher Locke, so far in advance of his time, constructed a model government for North Carolina which, like many other ideal republics, proved to be a most visionary and impracticable scheme. How many inventions for securing perpetual motion, getting power out of one end of a machine without putting it into the other, have deluded their builders.

Yet many a seeker for perpetual motion has stumbled on a valuable labor saver, as many a hunter for gold has found a more valuable mineral. Chemistry descended from

alchemy, astrology from astronomy, medicine from sorcery. The long hunt for the philosopher's stone was not all in vain, for it added much to mineralogy. Basil Valentine was not looking for antimony when he found it. Had Kepler not cast nativities, told fortunes, and made horoscopes science might have waited long for his "three laws" and Newton been impossible. Kepler said "astrology as the daughter of astronomy ought to keep her mother,"—an act of filial obedience which in this case met with its just and promised reward, for the days of the daughter and her line are likely to be as long as the earth moves in its orbit. Out of Darwinism may yet come a knowledge of biological laws which Darwin dreams not of.

Both the centripetal and centrifugal forces are needed to keep earth in its orbit. Withdraw one and we plunge into the sun;—the other, and tangentially we go darting away into limitless space without even the comet's consolation. It is well to make haste, as the planets do, safely. There are many theories which, like the *ærolites* go plunging lawlessly about into every body's orbit but their own, creating immense consternation, dazzling light,—terror to the timid,—sensation to all, only at last to bury themselves suddenly out of sight. It is unnecessary to imitate Pope Calixtus in fulminating against these erratic visitors, for even if they rise to the dignity of comets their course is eccentric, and we may not expect them again for some hundreds of years.

Lord Bacon accused Copernicus of "introducing fictions into nature" by affirming that the earth moved around the sun and the moon around the earth. Sir Mathew Hale believed in witchcraft and tortured and executed old women accused of it. Richard Baxter wrote a work in favor of the severest punishments for sorcery and magic. John Wesley regretted the repeal of laws for the capital punishment of witches and said "that the giving up witchcraft is in effect giving up the Bible." Dryden believed conjunctions and oppositions of planets had a great part in the distribution of good and evil, and

in the government of sublunary things. Liebnitz, the great mathematician, rejected the law of gravitation. La Place denied the undulatory theory of light. Lord Brougham ridiculed Young, who demonstrated that theory twenty years before it was generally accepted. The Edinburgh Review denounced him as a dreamer, though Tyndall now declares him one of the most remarkable men England ever produced. The reality of witch miracles was affirmed for several centuries, after investigation by some of the ablest men and the law courts of every European country. The belief in the power of the king's touch to cure scrofula flourished in the most brilliant periods of English history, after numerous public experiments. It was asserted by the privy council, the bishops of two religions, the general voice of the clergy in the palmiest days of the English Church and the University of Oxford. It survived, Leckey asserts, the reformation of Bacon, Milton, Hobbes and Locke.

These facts and every page of history teach the same lesson,—the fallibility of the human understanding,—the weakness of human judgment,—the strength of human prejudice and, above all, the wisdom, justice and necessity of liberal tolerance of opinion. Humanity advances alike in its knowledge of natural and moral law. It mistakes and corrects—blunders and revises—stumbles and rises—yet falls forward, and advances. The Spanish Inquisition and the Ptolmaic theory are together buried. The misery and mischief which grew out of the endeavor to enforce them by dogma and persecution are warnings to both scientists and theologians.

Any notice of the life of Agassiz, however brief, would be incomplete without some reference to his glacial theory. His name is identified with it, not because he alone originated it, for De Sausure, Rendu, Forbes, Charpentier, and others were engaged in glacial investigation, before or contemporary with him. He went upon the glaciers himself, lived upon one for three weeks, crawled into its crev-

ices, crept under it, planted iron rods in straight lines across it, and with theodolite and assistant engineers ascertained its motion per hour; the relative motion of its different parts, the effect of that motion upon the rocks and earth adjacent. From these long and laborious investigations in the Alps and the Jura, he extended his researches to Britain and afterwards to this continent, commencing, as we have seen, on his first short sojourn at Nova Scotia, and continuing it wherever he went. His theory was that the earth from each pole to about the latitude of 32 degrees north and south of the equator was once enveloped in great sheets of ice thousands of feet thick, which gradually retired as climates were established, receding pole-ward and remaining yet in Greenland, whence the icebergs come. Agassiz was always hunting for evidences of glacial action, and always finding it, until his theory has become in great part established, though some of its details even yet remain among the *agenda* of science—things yet to be proven. The never tiring diligence of Agassiz and the keen insight exhibited in his observations of glacial action, led some one to say that every boulder would hereafter be his monument. The immense rocks often found in this country, frequently on the level prairie, with generally deep furrows cut upon their surfaces, were as much a puzzle to most people before the glacial theory as were the marine shells found on mountain tops before Leonardo da Vinci's fossil theory explained them. It was as reasonable, too, to suppose they grew by some occult force in nature where they are found, as was contended by wise men in the case of marine fossils found many thousands of feet above the level of the sea. Granite boulders in great numbers are found hundreds of miles south of any granite stratum, which in this region does not show itself south of Lake Superior. They often weigh many tons, are found on or near the surface, and distant from rock of any kind. It is clear they must have grown there, or have been carried in glaciers or icebergs, which are floating fragments of glaciers. Wordsworth refers to these boulders, once regarded with

as much awe and mystery as the monuments at Stone Henge. He says

A large stone is sometimes seen to lie
 Couched on the bald top of an eminence,
 Wonder to all who do the same espy
 By what means it could thither come and whence,
 So that it seems a thing endued with sense,
 Like a sea beast crawled forth that on a shelf
 Of rock and sand reposes—there to sun itself.

If Wordsworth's *Excursion* had been geological he would probably have understood the boulder better, and then, the mystery being gone, we might have had an essay on glacial action instead of a beautiful poem. Fortunately we are able to have both. Ignorance and superstition are no longer considered essential to the highest type of poetry or religion, nor a knowledge of physics fatal to either. Happier than by-gone centuries the nineteenth appreciates poetry in science as well as science in poetry, and religion in both. The leading features of the glacial theory may be considered as established, though, a feeble fight is yet kept up against the Glacialists by the Diluvialists, who attribute the drift beds to Noah's flood. Its important bearing on all theories of the earth's formation, geologic epochs and time, the beginning and progress of vegetable and animal life, the introduction of man, will readily occur to all. Theories grow like some scientists say the earth grew. At first they are very thin and nebulous. Some, by swift revolution and laws dimly understood, become more and more solid until they harden into granite. Others never harden. They fade away, become comets or remain cloudy mists through which anybody can see who chooses to look with scientific eyes, Whatever may become of many hypotheses just now in their first whirling stage, the boulders are here by millions, often in great groups, forming "lithological parliaments" as an English geologist expresses it, or "stone mass conventions," as we would say. They are hard facts, solid condensed logic, granite syllogisms, which all the ologies must consider. Agassiz's great interest in them had a foundation, the extent of which becomes evi-

dent as science extends its discoveries and widens its field. He rather whimsically lamented that there are no glaciers in eastern North America. His first publications in Europe were upon glaciers and their action. He continued his investigations throughout his life, though his special field was natural history. He was constantly drawn from embryological and zoological studies to contemplation of that period in geologic time when those great "plow shares of God"—moving continents of ice,—were hollowing out the lake beds, smoothing the surface of the earth and preparing it by glacial deposit for the coming of man. With equal facility his great mind turned from investigating the sublime phenomena evident in the building of a world to a consideration of the structure of the minutest animalcule that inhabits it.

There are many lessons in the life of Agassiz. There is one to young men entering upon life with high aspirations and great embarrassments. He wrote before coming to America, "I shall be obliged to live very economically. My work thus far has rewarded me so well for the privations which I have suffered that I have no temptation to adopt another style of life, even if I have more trouble to live in America than in Europe." We have seen with what frank gratitude he acknowledged Humboldt's invitation to a dinner which was beyond his straitened means, with what heroic spirit he looked forward to yet greater privations. We have also seen him when his reputation was co-extensive with civilization and all the avenues to ease and affluence invitingly open before him, still pressing on the same earnest, unbribed student of nature, with "no time to make money."

There is a lesson to educated Americans, who seek in foreign lands the facilities for research and culture in science which may be better found at home. Writing to Prof. Silliman before he had visited this country Agassiz said "I have truly need to replenish myself anew in the fields and I hope to reap a rich harvest for science in America." The great museums, libraries, galleries and

collections of Europe had less attractions for him than the vast, unexplored regions of America. Like Humboldt he fairly reveled in the vegetable and animal wealth of this continent. For such men, South America, that land of wonders and magnificence, with its intricate net work of rivers, its dense and pathless forests swarming with life in novel and wondrous shapes, its numerous water courses crowded with aquatic animals unknown elsewhere, and the very air teeming with myriad shapes, gorgeous and grotesque, had an irresistible attraction.

Agassiz loved the freedom and unrestraint of our country as well as its newness and its novelty. He was a Swiss Republican transplanted to a more congenial soil. No doubt he often thought of the Revocation of the Edict of Nantes, which drove his ancestry from France, and notwithstanding the strong inducements which were held out to him to return to Europe, well knew that where religion is in fetters, science is in chains.

The scientific observer should come to his work the freest of the free, unshackled by religious, political, social or educational prejudices. His aim is the truth, regardless of consequences. There is yet a vast amount of prejudice and bigotry in the world, standing right across the path of science and blocking the way of truth. We all smile at the granite bigotry and the adamant prejudice of our ancestors who battled against truths which all now admit, but we forget that an hundred years hence posterity may wonder and smile at us. How mighty are the bonds of prejudice? Who can say he is free from them? Who can say he is unfettered, when even yet we owe the very fashions of our garments, the forms of our salutations, the proverbs which rule our common life and many of our notions as to the unseen world and the world to come, to peoples who lived beyond the Ganges before the pyramids were built? Who can declare he is free to accept the truth regardless of consequences—that he would not have been a Mahomedan in Arabia—a Buddhist if reared in China, or a cannibal if his father had been king of the Tonga islands. We absorb from birth,—even be-

fore it, and hourly after, the ideas, traditions, modes of thought and mental habits of those who went before and the community about us. He who boasts he is indeed free is often most a slave. The man who can look the truth squarely in the face with unquailing eye and accept the full consequence of adopting it, is even yet in this nineteenth century a rare man. Oftener he shudders at some social cross which his neighbors keep standing. He trembles at the outer darkness, against which all his education warns him. He shakes at sight of the Bastille of which his own friends are the sentries. He shrugs, subsides, and with bated breath meekly jogs along in the good, old ways of thought and belief, while Torquemada rattles his chain, exhibits his thumb screw, counts his rosary, and gives thanks that he is not as the heathen are.

The lessons of Agassiz's life to his own compeers in learning, by steadfast pursuit of the truth for the truth's sake only, and by unceasing effort to make the hitherto locked up learning of science the common wealth of all men, are written upon every page of his history.

His lesson to teachers in studying nature from nature's own open volume, the original author rather than books by compilers, promises to revolutionize the method of study so long in vogue in our country, so profitless and barren in results, so misleading, discouraging and harmful. The museum of comparative zoology at Cambridge and the school of Natural History at Penikese, so earnestly fostered by Agassiz, will be nurseries to produce a class of investigators and observers hereafter, competent to render baseless De Tocquville's fear that America never would send one great original investigator into the world.

Speaking of Humboldt's religious views and his alleged scepticism, Agassiz said that his great patron and friend was certainly no materialist, attributing to matter and force that world which he spoke of reverently as "God's Majestic realm." He said further that "it is impossible to become familiar with his writings without feeling that if Humboldt was not a believer, he was not a scoffer?" As much, and more, may be said of Agassiz.

To him who in the love of Nature holds
 Communion with her visible forms she speaks
 A *various* language.

Perhaps few are privileged to understand this language, spoken to such high priests of nature as Humboldt, Linnaeus, Newton, Cuvier and Agassiz. We have learned from science that there are sounds too deep for the ordinary human ear, that there are colors which the common eye cannot see. The undulatory theory of light has shown us that the infinitesimal waves of ether or air are by wise provision accommodated to our common human wants and organs. Too great keenness of the senses would result in powers beyond our need and miseries beyond our endurance. Man wants not the eagle's eye, the vulture's scent, nor the fox hound's ear. It is said that the wonderful ability of great cetaceans to communicate with each other at vast distances under the ocean is owing to their ability to produce and to hear sounds too deep for human ears. It would be no great stretch of imagination to fancy such giants in the wide ocean of thought as Humboldt and Agassiz thus endowed. Their lives and writings manifest an awe of the Creator, unfelt and not comprehended by men who have not, like them, been in the Presence and before the altar. Such an awe was that Prof. Tyndall said he always felt when looking upon the swift crystallization of certain substances into beautiful forms before his eye, each molecule seeming endowed with intelligence and evidently obeying an inscrutable law of a great Thinker. Such an awe Newton felt when nearing the end of long, intricate and laborious geometric calculations, the beauty, the symmetry, the order and the law as manifested in the solar system burst upon him in all its magnificence, and he was forced by overpowering mental excitement to employ a friend to finish his work. Such an awe the physiologist, Draper, felt when investigating the functions of the brain, its hemispheres conversing with each other, cerebral sight, and the wonderful organism of the nervous ganglia, he entered the inner sanctum of the temple of thought and, reasoning in-

ductively from the facts of his science, demonstrated, as he believed, the existence and immortality of the soul and looked upon its seat; this, notwithstanding it has often been said that wherever there are three physicians there are two atheists. Such an awe Fraunhofer felt when the sun first wrote in brilliant colors on the spectrum the secrets of its elements and told what the stars are made of. Such an awe Agassiz felt when in his microscopic labors he traced life down through the embryo, the egg, the vesicle and the germ, wherein the Creator first hints his purpose to all animal life. Such an awe Humboldt felt when returning from his long tour through South America he found the great city of Caraccas, where he had formerly pleasantly sojourned, buried in ruins, twelve thousands of its people entombed alive, and churches, palaces and hovels swallowed up in one common grave. Looking upon the desolation, he said "Our friends are no more; the house we lived in is a pile of ruins: the city I have described no longer exists. The day had been hot, the air was close, the sky without a cloud. It was Holy Thursday: the people were mostly assembled in the churches. Nothing seemed to foreshadow the threatening misfortune. Suddenly at four o'clock in the afternoon, the bells, which were kept mute that day, began to toll. It was the hand of God, and not the hand of man, which rang that funeral dirge."

There are Ariels in the air whose music none but a Prospero can hear,—

Sounds, and sweet airs, which give delight and hurt not,

but which are not for ears untutored to their mysterious melodies.

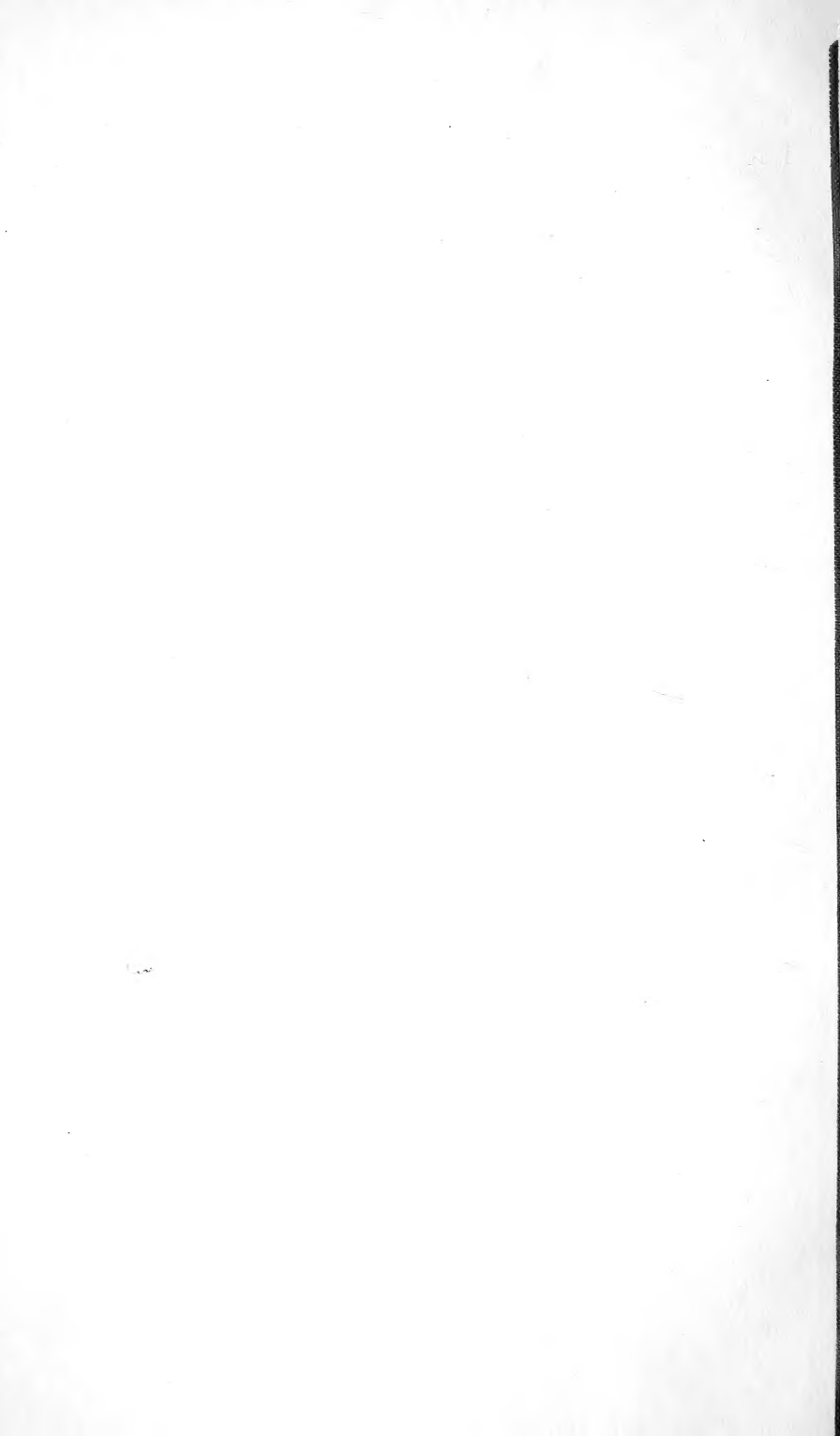
Such harmony is in immortal souls,
But whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it.

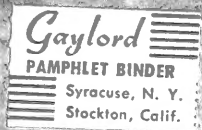
There is "an electric chain wherewith we are darkly bound." There is a border-land of science, a dim, mysterious and shadowy realm. Into it brave spirits are constantly making incursions, and the line between the known and the unknown, between fact and mystery, has

by their noble audacity been receding for three hundred years. Gorgons and chimeras dire that once threatened them have vanished into thin air, but other hobgoblins, with shapes and sounds portentous, still dispute their advance. Yet the brave band moves on, and never so bravely as now. When protoplasm, the nebular hypothesis, evolution, monads and the origin of life have vanished as shadows or are organized into substantial shapes, there will be other Gogs and Magogs to dispute the way. Of this boundary line Agassiz, speaking of Humboldt, said: "Like a true philosopher he knew that the time had not yet come for a scientific investigation into the origin of all things. Before he attempted to discuss the direct action of a Creator in bringing about the present condition of the universe, he knew that the physical laws which govern the world must be understood; that it would be a mistake to ascribe to the agency of a supreme power occurrences and phenomena which could be deduced from the continued agency of natural causes. Until some limit to the action of these causes has been found, there is no place in a scientific discussion, as such, for the consideration of the intervention of a Creator. But the time is fast approaching and, indeed, some daring thinkers have actually entered upon the question. Where is the line between the inevitable action of law and the intervention of a higher power? Where is the limit?"

This solemn question remains unanswered. But that fearless band, undismayed by dogma or tradition, yet in the reverence and awe which Agassiz felt, presses on—and on—and on. Even now it is in the cloud that envelops in mystery the mountain tops of thought, from out of which to us all comes a voice of admonition saying: "Put off thy shoes from off thy feet, for the place whereon thou standest is holy ground."







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